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A New Refractory Material

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"Moler" is the local name for a foliated diatomaceous deposit found in the argillaceous eocene deposits in Jutland, northern Denmark, particularly in Mors, Fur and at Silstrup and Ertbolle on the Lim Fjord. Up until recently no use has been found for this material.

Mr. G. A. Heyermann, director of the Royal Polytechnic Institute of Copenhagen tried to use it in the mixture for sand-lime bricks, but found it unadapted to this use. The Clay Laboratory of the Danish States Testing Laboratory has, however, been successful in producing bricks from mixtures of clay and moler in various proportions, and from moler alone, with very interesting results, particularly as concerns the properties of these bricks.

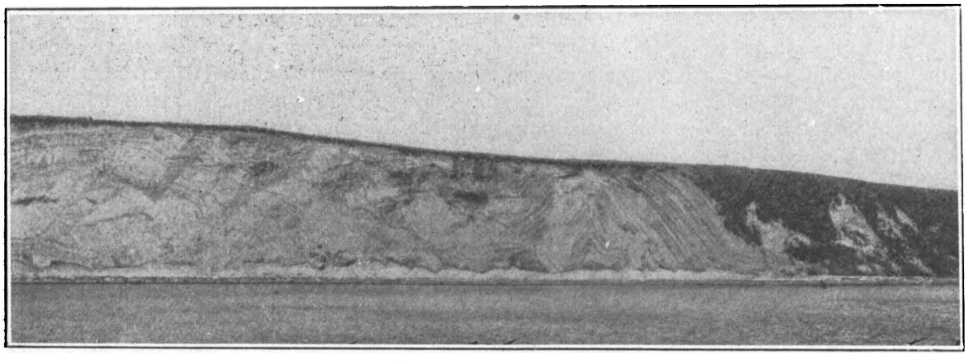

FIG. 1.—CLIFF OF MOLER DEPOSITS.

In the first tests, moler was mixed with 25, 50 and 75 per cent of marl, and with 25 and 50 per cent of red clay; afterwards bricks were burnt from moler alone. Contrary to expectations, moler alone burnt to a fine red brick, very firm and light, and of such toughness that a nail could be driven through without cracking it. The specific gravity of these bricks was about 1, and their strength about that of common bricks.

These results were so encouraging that the "Skrikes Institution" made a grant of 1000 kroner to investigate the possibility of founding thereupon a new industry. The chief engineer of the Clay Laboratory, Mr. Fischer-Moeller, inspected the moler deposits in company with Captain Loof, of Hobro, and Dr. V. Madsen, State Geologist, and succeeded in finding a fine bed of the material at Ejersley, provice of Mors.

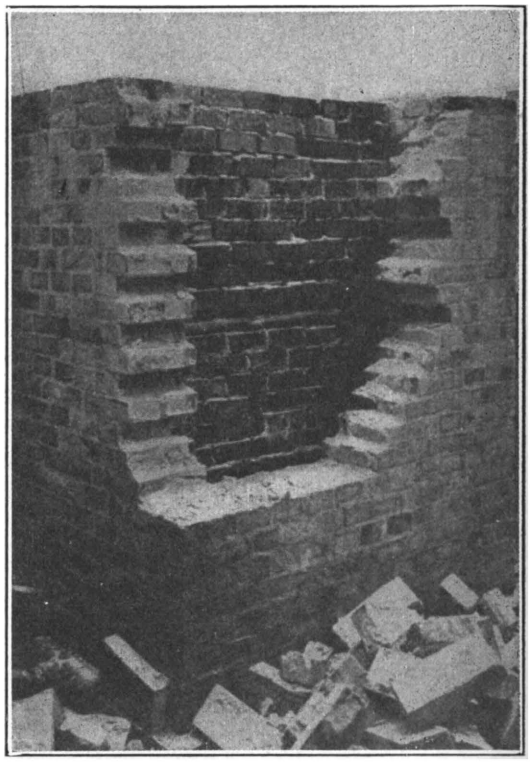

FIG. 2.—MOLER BRICK FURNACE.

This is exposed as a cliff 16 m to 20 m high, the white moler being in corrugated strata interspersed with dark stripes of volcanic ash (Fig. 1). The moler was separated from the volcanic ash, and Captain Loof burnt a quantity of it into bricks in his brick-kilns at Vindo, near Hobro.

Various methods of molding, drying and burning were tried, and bricks produced with specific gravity of 0.87 to 1.13 (hardest burnt), and crushing strength 86 to 230 kg per square centimeter (1230 lb. to 3290 lb. per square inch). In all cases their power of absorbing water was considerable, up to 50 per cent of their weight. Their particular properties are their great strength in proportion to their lightness and the heat insulating quality. They are suitable for partitions, floor constructions, arches of every form. They are not suitable for outside use, because of their porosity and absorption of water.

As a refractory they are, however, a most promising material. Their porosity makes their heat conductivity unusually low, and it remained only to test their behavior under strong heat. In the Eastern Gas Works, Mr. Irminger constructed the arches above the retorts of them; at the poor house, Sundholm.

Copenhagen, the chief engineer used them for the masonry of steam boilers. In both cases they resisted the heat satisfactorily.

The Frederiksholm Brick & Limeworks Company, Ltd., had the Clay Laboratory conduct some careful experiments to determine their refractoriness. For this purpose, a small vertical shaft (Figs. 2, 3 and 4) was constructed 1.5 m (5 ft.) high,

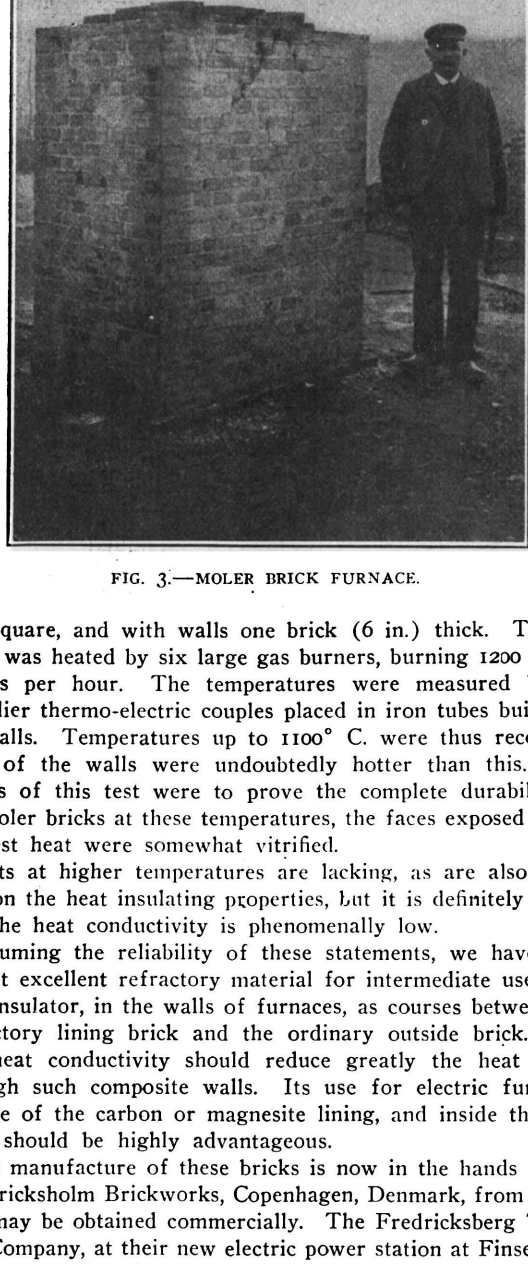

FIG. 3.—MOLER BRICK FURNACE.

1 m square, and with walls one brick (6 in.) thick. The interior was heated by six large gas burners, burning 1200 cu. ft. of gas per hour. The temperatures were measured by Le Chatelier thermo-electric couples placed in iron tubes built into the walls. Temperatures up to 1100° C. were thus recorded; parts of the walls were undoubtedly hotter than this. The results of this test were to prove the complete durability of the moler bricks at these temperatures, the faces exposed to the greatest heat were somewhat vitrified.

Tests at higher temperatures are lacking, as are also exact data on the heat insulating properties, but it is definitely stated that the heat conductivity is phenomenally low.

Assuming the reliability of these statements, we have here a most excellent refractory material for intermediate use, as a heat insulator, in the walls of furnaces, as courses between the refractory lining brick and the ordinary outside brick. The low heat conductivity should reduce greatly the heat losses through such composite walls. Its use for electric furnaces, outside of the carbon or magnesite lining, and inside the iron shell, should be highly advantageous.

The manufacture of these bricks is now in the hands of the Frederickshom Brickworks, Copenhagen, Denmark, from whom they may be obtained commercially. The Fredricksberg Tramway Company, at their new electric power station at Finsensvej, have used 40,000 of them in setting their boilers, also, because of their heat insulating properties, for the masonry of "economizers," and, because of their lightness, for lining a large high horizontal flue.

The above data are taken from a recent report of the Danish State Testing Laboratory, which, under the title "On the Development of Testing of Materials in the North," was presented to the members of the Fifth International Congress for Testing Materials, recently held in Copenhagen.